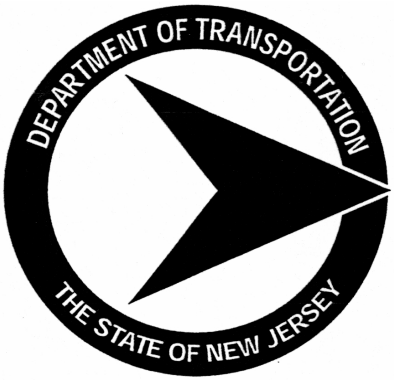
New Jersey Department of Transportation

ITS Investment Strategy

10-Year Program, FY06-15



Division of Traffic Operations
Bureau of ITS Engineering
March 2005

Intelligent Transportation Systems/Traffic Operations Investment Strategy

A 10-Year Program, FY06-16, to advance the design and construction of an ITS Infrastructure in NJ

Overview of ITS

As stated on the Department's web site "Nothing is more frustrating to the traveler by automobile or bus than being delayed in traffic."

New Jersey, the most densely populated state in the nation, needs a fully operable Intelligent Transportation System (ITS) because it is a vital tool in the effective management of traffic. In 2002, delays cost each NJ motorist 60 hours per year and have a cumulative yearly economic loss to NJ of $7.3 billion in time, fuel and additional vehicle operating costs. Each year NJ suffers over 700 roadway fatalities, 100,000 injuries and 330,000 accidents.

According to the FHWA, Metropolitan ITS systems on average have a cost benefit ratio of greater than 8 to 1. Freeway management systems can reduce accidents by 15% and increase capacity by 17% to 25% while Incident Management programs can reduce incident related congestion by up to 50%.

By optimizing traffic flow, computerized traffic signal system can also provide capacity improvements of 15% or more with a significant reduction in fuel usage and fumes generated for an additional environmental benefit.

How can the use of technologies on highways help reduce congestion? Imagine a doctor trying to improve blood flow through a patient's clogged artery and compare it to an incident on the highway blocking the flow of traffic. One solution would be to perform coronary bypass surgery, or, in ITS terms, create a "diversion route". Another solution is to remove the obstruction, or, in ITS terms, "dispatch emergency service personnel as soon as possible in order to remove the stalled or damaged vehicle(s) and clear the roadway so that traffic can flow safely again". ITS also assists in "preventative maintenance care". For example, Dynamic Message Signs (DMS) and Highway Advisory Radio (HAR) provide advanced notice of pending trouble ahead whereby offering motorists opportunities to change their route and avoid unnecessary delays and hazardous conditions, or simply remind them to slow down and maintain safe distances so that crashes don't happen, similar to a doctor recommending exercise and a healthy diet. ITS provides Traffic Operations with tools they need to manage traffic effectively by alerting motorists of adverse conditions and notifying emergency personnel of incidents for quick response, on a 24 hour real-time basis, all to keep a heavily congested transportation body alive and kicking.

Consistent with the goals of the Department, the deployment of ITS technology helps reduce traffic congestion, improve public health and safety associated with transportation, increase opportunities for local and region-wide economic development by improving transportation mobility, and enhance the quality of life for towns and communities.

According to the New Jersey Institute of Technology, "in order to mitigate congestion in New Jersey there must be a balance between the construction of new highway and transit facilities with the use of advanced technology such as advanced traffic control and intelligent transportation systems." In addition to the NJIT recommendation, various other sources require and/or recommend the commitment of the State of New Jersey to establish and implement a technology program on state roadways. These include:

- NJ statute 27:1B-21.16 which requires "the deployment of the best available technologies on roads and highways".
- FHWA Rule 940 requiring all federally funded projects to provide a "Systems Engineering Analysis" and the development of an "ITS Architecture".

In 1999, the Institute of Transportation Engineers (ITE) prepared the recommended practices for the proper management and operation of ITS. The following list contains key elements of their findings.

1. Commitment - Assurance of a firm commitment is recommended at the appropriate level by State DOT's and participating agencies.
2. Information Sharing – Traffic control strategies must reach across jurisdictional boundaries and form an integrated network management system. Agencies should consider sharing operation, control and monitoring functions through regional coordination.

3. Planning – A systems engineering process is necessary to build and integrate systems. ITS devices need to be brought to compliance with adopted national standards and the overall strategic plan needs to be updated and made current over the course of time.
4. Incremental Design – Staged development and deployment of the system is an ongoing part of each individual project. Projects should be proposed in incremental steps in order to produce the most immediate effects on operations and so that the potential benefits of the systems are realized.
5. Computer Systems – A long-term program is necessary for supporting computerized traffic management systems. As systems grow in complexity, and interaction with other devices increases, hardware and software components will need upgrading, debugging, troubleshooting, replacement, and revision. Automatic traffic management systems are ever-changing with technology advancements, therefore making a program of configuration management necessary for modification control. Design changes can then be made logically and efficiently without backtracking. Disaster recovery is needed for restoration of damaged or failed equipment.
6. Procurement – Spare equipment and warranties are critical for continued operation once systems are put in place. Purchasing rights to source code and protocols is also smart for software acquisition development contracts.
7. Interagency Opportunities – Agencies should look for and capitalize on transportation technology sharing opportunities in order to develop win-win situations such that benefits are maximized. Communications paths and devices and most importantly the traffic data should be shared when possible among multiple jurisdictions. Joint operations through an "open systems architecture" makes information transfer between computer operating environments more easily accomplished and is strongly recommended.

This report does not cover other ITS related devices that are controlled by other groups outside Traffic Operations. These include weather stations, weigh-in-motion stations, traffic data monitors, and other pavement/bridge sensors. There is a coordination of efforts by all groups for mutual uses, especially in emergence of the security needs of the Department.

Current Accomplishments

NJDOT began installing ITS systems in 1992, and by early 2005 we will have some level of ITS infrastructure on approximately 90 miles of Interstates/Freeways and 235 miles of other State highways. This includes over 300 miles of communication fiber, 163 cameras (CCTV), 66 DMS, 168 Speed Detectors, 211 computerized signals, and 14 HAR. An agreement was reached with the New Jersey Turnpike Authority in 2004 to establish a shared high-speed, redundant fiber connection network.

Two high tech Traffic Operations Centers (TOC), originally established in 1996, are the central focus for all transportation operations in the state. They use the ITS infrastructure to manage the flow of traffic on the highways and coordinate responses for traffic incidents. There is also a Central Dispatch Unit (CDU) co-located in 2004 with the NJSP & NJDEP Coordination centers to assist the TOC in coordinating work assignments for responding to incidents. Approximately 7,000 incidents are reported to the Traffic Operations Centers on an annual basis.

The Emergency Service Patrol Program (ESP) was launched in 1994 to help keep the highway lanes clear, reduce congestion and increase safety for all motorists. Since inception, ESP crews have assisted approximately 280,000 motorists with the assists steadily increasing up to 44,000 in 2003. The ESP has a benefit to cost ratio of 19 to 1 based on the savings in time provided by clearing lane closing incidents. ESP units patrol from 4:00 a.m. – 8:30 p.m. Monday through Friday, on a majority of holidays, and on weekends during the summer months. Also, ESP units provide coverage 7 days per week for the Route 29 Tunnel in Trenton. The ESP program currently covers over 325 miles of interstate and freeways.

Incident Management Response Teams (IMRT) were established in 1995 with the New Jersey State Police with specially trained personnel who respond to major incident scenes to expedite coordinated multi-agency remediation efforts. Diversion plans for major routes will have been established with all the Counties by early 2005.

We have a web site that provides real time traffic information, including live camera views of actual highway conditions with one million “hits” on the site in January, 2005.

Through the successful use of these systems; the average incident duration has been reduced to less than two hours from the 2 and one-quarter hours recorded in 2002.

An optimization of the Rt 73 Computerized Traffic Signal System (CTSS) in Camden County showed up to a 23% reduction in the time to travel the 17 mile length during rush hours. Other optimization assessments are currently underway at other CTSS statewide.

Construction contracts are now being developed to incorporate permanent and temporary cameras and traffic monitoring devices as a first item of work to assist in managing traffic flow through the construction impacts. Route 18 and Route 139 are two of the major projects this is currently being implemented on.

Goals and Budget

- **Total 10 year Program of $ 960m (including escalation)**
- **$ 47m in FY06**

Operating the System

A. Traffic Operation Centers, including Central Dispatch Unit - $24.7 m in FY06

- $12m to staff and maintain the centers and all ITS equipment
- $0.6m for Incident Management Response Teams (IMRT)
- $11m, and additional staffing, for Emergency Service Patrol (ESP) 16/7 (hour/day) coverage on all Interstates and Freeways
- $1m to operate a Traffic Information Web Site
- $0.1m to operate a 511 Traffic Information Phone Service

This effort includes:

- Periodic replacement or upgrades to existing equipment, hardware and software
- Periodic replacement of vehicles
- Communication and service usage costs
- Support through contractor and consultant contracts

B. ITS Engineering - $0.5m in FY06

- Provide technical support to the TOC
- Maintain the ITS Architecture for coordination of efforts between all agencies
- Maintain a GIS database and web site to coordinate any work on or near ITS facilities

C. Other Agency Support - $3m in FY06

- $1.9m to fund dedicated State Police troopers for IMRT
- $0.1m for NJ Turnpike's maintenance and repair of the Dense Wave "Ring"
- $1m to support TRANSCOM

Total cost of approximately $ 28.2m/yr to operate the system. Projected increase to $37.5m/year by 2015 for a fully enhanced system, including additional staff.

Enhancing the System

A. Expand Instrumentation

Interstates & Freeways: $ 371m over 10 years to complete remaining sections

- Cameras (CCTV) at every interchange and one at least every 2 miles for Urban areas and every 5 miles for Rural areas
- Signs (DMS) on each approach for interchanges with Interstates/Freeways, State highways, and other select roads
- Detectors (speed, etc.) at every Sign location
- Full fiber network connection network

Selected High Priority Arterials

Computerized Traffic Signal Systems: $ 49m over 10 years

This is based on completing the respective sections of highway locations currently listed as severely congested corridors by the Bureau of Systems Development and Analysis (see Appendix A) and other major relief/diversion routes such as Route 46 for I-80 and Route 130 for the NJ Turnpike. Costs include signal controller replacements, DMS, CCTV and Detectors, but no other signal and geometric upgrades. Connections will be by fiber in some critical locations, with others by phone, cable, or wireless.

Isolated devices at selected locations: $30m over 10 year period

Note: other improvement projects will also include ITS components as warranted and some of this funding may be accounted for in the individual project funding items over the next 10 years.

C. Enhance Operations Centers

Construct a Statewide Traffic Operations Center (STOC) – implement in FY06 through NJTPA

Construct a Central Traffic Operations Center (TOC-C) – implement with STOC

- Twenty additional staff positions
- $3m in FY06 towards building/equipment, and implementing a statewide traffic management software system

Construct new North Traffic Operations Center (TOC-N) – implement with new Region North Headquarters, $2m for equipment upgrades (building funds not included here)

Connect the existing TOC-N within the Dense Wave "Ring"

- $.5 Design in FY06
- $1.5m Construction in FY07

Complete full "node" connectivity with Dense Wave "Ring" - $0.5m in FY06

Develop automated ESP dispatch system – proposed $.5m in FY06

D. Enhance Engineering Support

Prepare and coordinate contract documents to construct new ITS

Develop and maintain a Traffic Operations web site

- Provide live video images - $2m FY06
- Provide real time projections – devices under A. above, $.5m in FY06 for new software

Develop & issue ITS standards and guidelines

Corridors in development that should be completed by 2010 within the above goals:

Rt 18: Rt 27 to Rt 9 – CPM and ITS projects under construction in 2005

Rt 22: MP 40 to 47 – CTSS project in scoping

Rt 29: Rt 1 to I-295 – includes enhanced tunnel operations

Rt 46: MP 49 to 71

I-78: Newark to I-287

Rt 130: MP 61.4 to 74.4

Rt 139: Rt 1&9 to Holland Tunnel – Contract 2 to be awarded early 2005

I-287: I-80 to Rt 440 – fiber and partial instrumentation under construction in 2005 up to I-78

Summary and Projected Benefits

Although the national reports and the data we have collected shows that ITS provides a significant benefit, we have conducted limited studies to fully evaluate the ITS system. The majority of other States are also still developing how they will track performance for ITS systems. There are complications associated with measuring the benefits of ITS projects, especially when the ITS components are incorporated with other improvements. Many of the benefits are an increased awareness for the driver so that better decisions can be made by each individual that will provide an overall improvement to the safety and congestion of the system for all.

It is intended that future ITS improvements will include an evaluation component to bench mark pre-construction conditions and ascertain the benefits of each project after completion. In general, we will be evaluating the following four major categories:

- Reduction in Incident Durations
- Reduction in Congestion – recurring capacity versus incident and other isolated factors
- Increase in Safety
- Well informed public

Over $ 960m is a major commitment to provide what we feel will be an optimum, operating ITS system, however, in a State as New Jersey where construction expansion is restricted, using ITS is one of our best opportunities to provide significant improvement to the motoring public.

The majority of this Program is expected to be federally funded, including operation and maintenance of the system. Any expansion and enhancement of the system must include the commitment to funding the respective operating needs in order to fully realize the benefits. Construction will be completed through separate ITS contracts and as components of other improvement contracts through Capital Program Management and Operations. A state funded Smart Moves Program is recommended to continue on a yearly level of $5-6m to provide for low cost, short time frame, spot improvements and other quick evaluation efforts.

APPENDIX A

Potential Traffic Signal Contracts

Route	Beginning M.P.	Ending M.P.	Total Miles	Existing CTSS	Remarks
1	33.06	35.12	2.06	6-31.5	
3	3.40	6.50	3.10		No Signals
4	0.23	2.38	2.15		
9	87.30	89.80	2.50	.2 - 3.56	
9	98.60	101.60	3.00	102.86-126.44	
10	9.17	14.50	5.33		
17	10.30	15.82	5.52		
22	28.60	34.77	6.17		Scoping 40-47
37	6.48	9.33	2.85	0.6-12.8	
41	3.91	6.15	2.24		
46	56.40	60.09	3.69		
66	0.16	3.62	3.46		
70	55.80	58.17	2.37	0-16	
88	0.00	2.20	2.20		
88	5.18	9.64	4.46		
124	2.25	7.15	4.90	0.6-1.5	
166	0.08	2.23	2.15		
168	4.30	7.02	2.72		
202	27.80	29.82	2.02	44.3-45.07	
202	70.50	73.00	2.50		
202	77.00	79.00	2.00		
			67.39		

Notes:

1. Data from severely congested links (v/c greater than 1.20) by the Bureau of System Development & Analysis
2. Selected Route Sections greater than 2 miles, including possible breaks in sections less than one mile
3. Other Locations of Existing CTSS

1 Bus.				0.9-1.1	
1&9				36.85 - 45.44	
18				35.1 - 41.75	2005 Upgrade
30				2-32	
31				22.2 - 24.4	Under Const.
38				1.8-16.7	
73				9-39	